Alternative Feedstocks in the Polymer Industry

Status and Perspectives @ Covestro

Dr. Vera Eßmann
New Technologies
Covestro Deutschland AG
Covestro at a Glance

Sustainability at Covestro

Status: Successful Examples

Perspectives

Summary
Covestro at a Glance
One of the world’s leading polymer producers

TO MAKE the world a brighter place

- HIGH-TECH POLYMER MATERIALS
- POLYCARBONATE
- POLYURETHANES
- COATINGS
- ADHESIVES
- SPECIALTIES

curious courageous colorful

Euro ~14.1 bn. Sales >10,000 Products

approx. 16,000 EMPLOYEES

Since September 1st, 2015 as Covestro
30 sites, 8 of which in world-scale format

#PushingBoundaries
As of March 07, 2018
Sustainability at Covestro
Sustainability goals along the value chain

- **Research & Development**
  - Our R&D project portfolio aligned with UN Sustainable Development Goals

- **Procurement**
  - 100% of suppliers compliant with our sustainability requirements

- **Production**
  - Reduce specific CO₂ emissions by 50%

- **Products on the market**
  - 10 million people in underserved markets reached through our business solutions

- **Across the value chain**
  - We aim to get the most value out of the carbon employed
Sustainability at Covestro
Focusing on the entire value chain

Reduce impact on the planet …

Foster Life Cycle Thinking

Drive development of PPP product solutions (People, Planet, Profit)

… and increase profit for society
Sustainability at Covestro

Implementation of alternative feedstocks in the polymer industry

Crude Oil → Refinery → Fuel Oil → Cracking → Ethylene
 → Propylene
 → C4-Crude
 → Aromatics
 → Others

Alternative Feedstocks

bio-naphtha
drop-ins
near drop-ins, new building blocks

http://chemengineering.wikispaces.com/Petrochemicals
Sustainability at Covestro
Sustainable raw materials for our products

**POLYCARBONATE**

Polycarbonate + recycled material biobased material → PC blends

**POLYURETHANE**

Isocyanate + Polyol → Polyurethane

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Bio-based Building Blocks for Aliphatic PUR

Covestro developed a bio-based diisocyanate (PDI*) which is used as building block for coatings, adhesives, and specialities.

Incorporating renewable materials to increase sustainability.

*PDI = Pentamethylenediisocyanate
Bio-based Building Blocks for Aliphatic PUR

Industrial sugar → Fermentation → Pentamethylene diamine

\[ \text{Industrial sugar} \xrightarrow{+ \text{NH}_3} \text{Pentamethylene diamine} \]

\[ \text{Industrial sugar} \rightarrow \text{Pentamethylene diamine} \]

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\[ \text{NH}_3 + \text{CO}_2 \rightarrow \text{H}_2\text{O} \]

\[ \text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{CO}_2 \]

The first isocyanate with significant biocontent: 70% renewable carbon*

Significant reduction of the carbon footprint: ca. 30% reduction**

*% renewable carbon, 14C measurement according to ASTM-D6866 standard

**based on internal calculations

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Bio-based Building Blocks for Aliphatic PUR

Desmodur® N 3300

- HDI Trimer
- Potlife
- Gloss
- Chemical resistance / weathering resistance
- Scratch resistance
- Film hardness

Desmodur® eco N 7300

- PDI Trimer
- High solid content
- Drying
- Compatibility with PES polyols
- Biocontent
- Film hardness
- Potlife
Bio-based Aniline

Aniline – usually based on crude oil

- Strategic raw material for the chemical industry
- Aniline usually based on fossil resources like crude oil
- COVESTRO uses ca. 1 million tons per year = 20% of global aniline consumption
- Usage: for polyurethane foam to insulate buildings and cooling devices

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- Crude oil
- Benzene
- Nitrobenzene
- Aniline
- Polyurethane
Bio-based Aniline

Aniline – Aiming for industrial production

COVESTRO can produce aniline without using fossil raw materials

Based on biomass: unrefined raw sugar e.g. from field corn, wood or straw

Step 1: Biocatalysis sugar becomes pre-aniline through microorganism

Step 2: Chemocatalysis pre-aniline becomes aniline

Plant

Raw sugar

Intermediate

Aniline

Polyurethane
Bio-based Aniline

When vision becomes reality

100% biobased aniline

Saving reduction of CO₂ emissions

Saving fossil resources for future generations

Saving fossil resources for future generations

When vision becomes reality

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EU Projects: PERCAL

Chemical building blocks from organic fraction of MSW

Feedstock
Municipal Solid Waste (MSW)

Pretreatment
Hydrolysis
Fermentation

Intermediates
Lactic Acid
Succinic Acid for Polyols
Biosurfactants

Study of Adaptation & Monitoring of PERSEO biorefinery plant to the PEARL's target products.

www.percal-project.eu
Summary

✓ Covestro has established sustainable goals along the value chain

✓ Focus on alternative raw materials: biomass- and CO₂-based raw materials

✓ Successful examples:

Desmodur® eco N → bio-based hardener for coating applications
Bio-based Aniline → bio-based building block for polyurethane applications
Cardyon® technology → insertion of CO₂ in polyols for polyurethane applications
Impranil® eco → bio-based polyurethane dispersion for textile coatings

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